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MORPHOMETRIC STUDY OF THE PHOENICIAN ANTHROPOID SARCOPHAGI (SIDON AND AMRIT)

Bashar Mustafa[1], Francisco J. Esquivel[2] and José A. Esquivel*[1]

[1]*Department of Archaeology, Cartuja Camps, University of Granada, Spain*
[2]*Department of Prehistory and Archaeology, Cartuja Camps, University of Granada, Spain*
[3]*Department of Statistics and Operations Research, University of Granada, Granada, Spain*

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Corresponding author: JOSE ESQUIVEL (esquivel@ugr.es)

ABSTRACT

This study focuses on analyzing and statistically interpreting, from the perspective of archaeological material culture, the anthropoid Phoenician sarcophagi found in Sidon and Amrit and dated to the second half of the first millennium BC. We will highlight how these funeral artifacts have focused almost exclusively on sarcophagi as artworks. The main goal of this research was to study the sarcophagi from an archaeological perspective with reference to the quantitative and qualitative data taken from each piece, in order to establish the source of materials used in them. We prioritize the most numerous groups from both areas, to formulate a hypothesis concerning the supply patterns of raw materials and the processing of each piece leading to finishing it with specific morphological features and its final delivery for funerary use.

KEYWORDS: Levant, Morphological study, Protohistory, Sarcophagi, Statistical Analysis.

1. A REVIEW OF PREVIOUS STUDIES OF PHOENICIANS ANTHROPOMORPHIC SARCOPHAGI

Phoenician anthropoid (human-form) sarcophagi conjure up a variety of contradictory images reflected in faded mirrors of an ambiguous past. Most researchers believe that the origin of the anthropoid sarcophagus is in Egypt (Harden, 1963; Lembke, 1998; Wenger, 2003), where certain religious concepts demanded special treatment of the corpse.

It has been hypothesized that Egyptian beliefs required, in order for the deceased to survive in the afterlife (Faegersten, 2003: 249), that an anthropomorphic image representative of the person inside exist on the sarcophagus (Kukahn, 1951). However, this hypothesis remains controversial to this day.

Anthropoid sarcophagi have been found along the Mediterranean coast in a large region called by the ancient Greeks "Phoiníke" or Phoenicia, which is the present day Lebanese coast and the southern coast of Syria (Aubet, 2009: 23; Woolmer, 2011). The exact boundaries of Phoenicia are unknown and who, precisely, was considered Phoenician is still very difficult to define.

However, according to many historians their lands were mainly on the Levantine coast formed by northern Palestine through Lebanon and southern Syria. One of the cities of primary concern to our study is Sidon (present-day Ṣaydā), located on the Lebanese coast, 48 kilometers south of the capital, Beirut. The ruins of ancient Tyre (present-day Sour) extend to the south some 30 kilometers. Today, Sidon is one of the best-known sites on the ancient historical "Canaanite" coast (Kukahn, 1951; Aubet, 2003; Dixon, 2013), because of the fifty-nine sarcophagi that have been discovered in cemeteries, necropolises, and in isolated graves distributed around this ancient metropolis (Wenger, 2003; Saidah, 2004; Frede, 2009). Sarcophagi have also been documented in other cities of Lebanon. Notable are those in Berytus (Beirut), Tripoli (Ṭarābulus), Byblos (Ŷubayl), and Tyre (Ṣūr) (Wenger, 2003: 2; Saidah, 2004).

In the southern shore of Syria, to the South of Tartus city about seven kilometers lies our second region of interest, the ancient city of Marathus, or modern day Amrit, thought to have been affiliated with the Phoenician culture (Bartoloni, 2003). Located about five hundred meters from the coast, the archaeological site occupies an area of six square kilometers. Its ruins are distributed between the al-Quable and Marathus rivers. The combined territories of Amrit and the island of Arados, just off the coast about 2,500, meters comprise so-called "Northern Phoenicia" (Sapin, 1980; Elayi and Haykal, 1996), according to archeological records. Thirty anthropoid sarcophagi have been discovered in this area; after Sidon it is one of the most productive areas in which to study these timeless funerary containers (Mustafa, 2013). The discovery of anthropomorphic sarcophagi has also been documented in smaller numbers throughout the Mediterranean basin in areas of Palestine (Gaza) (Frede, 2002), Egypt (Saqqara, Tell-el-Maskhuta) (Lipinski, 1992), Turkey (Mersin) (Frede, 2000), Cyprus (Amathus, Kition) (Georgiou, 2009), Greek Islands (Paros) (Karageorghis, 1993), Italia (Cannita) (Kreikenbom, 2002: 103; Leonardo, 2009), and Malta. Although these sarcophagi have different characteristics from those of Sidon and Amrit, some authors continue to refer to them also as Phoenician anthropomorphic sarcophagi (Frede, 2000, 2002). Two similar sarcophagi have also been found on the western Mediterranean coast at Gadir (present day Cadiz, Spain) (Blanco and Corzo, 1981; Almagro-Gorbea et al., 2010).

The vast majority of findings of anthropoid sarcophagi are from the eighteenth and nineteenth centuries (Wenger, 2003), an era marked by looters and grave robbers—a situation common during the colonial period of this region. The minimal documentation of early archaeological excavations coupled with incomplete information (Al Maqdissi and Benech, 2009) and lack of scientific rigor in the documentation that does exist poses many difficulties in the interpretation of findings and unfortunately provides us limited data with which to study them Over the past century and a half many archeologists and scholars have studied the anthropomorphic sarcophagus. Among them is E. Renan (1864), who directed his efforts toward arguing and justifying the Greek influence on these sarcophagi and awakened great interest in the study of Phoenician archaeology. Subsequently, investigations by A. Longpérier (1869) concluded that the first anthropoid sarcophagi date back to the ninth century BC. His research shows there is a definite linkage with sarcophagi of the east and that they were influenced by Assyrian sculpture. Then, A. Furtwängler (1893) was one of the first to compare the sarcophagi with classical sculpture using the temple of Zeus in Olympia as the main point of comparison for reliable examination. In the early twentieth century C. Torrey, in his first analysis of the sarcophagi of Ain Hilwah (Sidon), classified them as purely Egyptian productions, influenced by Hellenistic traditions (1919/20). The French archaeologist M. Dunand (1944/45) we can note definite changes throughout the history of these objects. From a production standpoint, it appears that the first sarcophagi were developed by Greek artisans. They were subsequently replaced by Phoenician craftsmen, which seems to have led to a decrease in the quality of the workmanship (Lembke, 2001). We

also note changes in raw material; local materials began to be used in these coffins gradually, piece by piece, eventually replacing the original marble (Elayi and Haykal, 1996).

Research scholar S. Frede (2000, 2002) stated in her Corpus that this group of Phoenician anthropoid sarcophagi are imitations of Egyptian sarcophagi, making her case based on measurements of the pieces. She made further deductions concerning their date of production by comparing them against classical Greek statuary (Zeus and Aristogeiton).

Archaeological evidence shows that Sidon and Amrit (Fig. 1) were not only principle Phoenician cities (Haykal, 1996a; Markoe, 2000), but the major centers of the use and possibly production of anthropoid sarcophagi (Elayi, 1992). Both cities provide key information for the study of funerary practices between the sixth and fourth centuries BC (Elayi, 1992). Sidon is known for a large number of cemeteries. Among these are Ain Hilwah (Torrey, 1919/20), located on the southeast of the city. Twenty-five sarcophagi (Dixon, 2013), have been found and documented after excavation by the American School between 1880 and 1888. The cemetery of Ayaa (Torrey, 1919/20; Wegner, 2003: 8), situated north of the main city, was also discovered by the same school, unearthing four sarcophagi. In Magharat Tabloun, located in southern Sidon and considered the ancient part of the city, 15 sarcophagi were discovered in 1855 by E. Renan. Also worthy of note are isolated tombs containing sarcophagi found in Merah, Baramie, Ain Zeitoun, and Miemie, all discovered in the nineteenth century (Frede, 2000; Wenger, 2003).

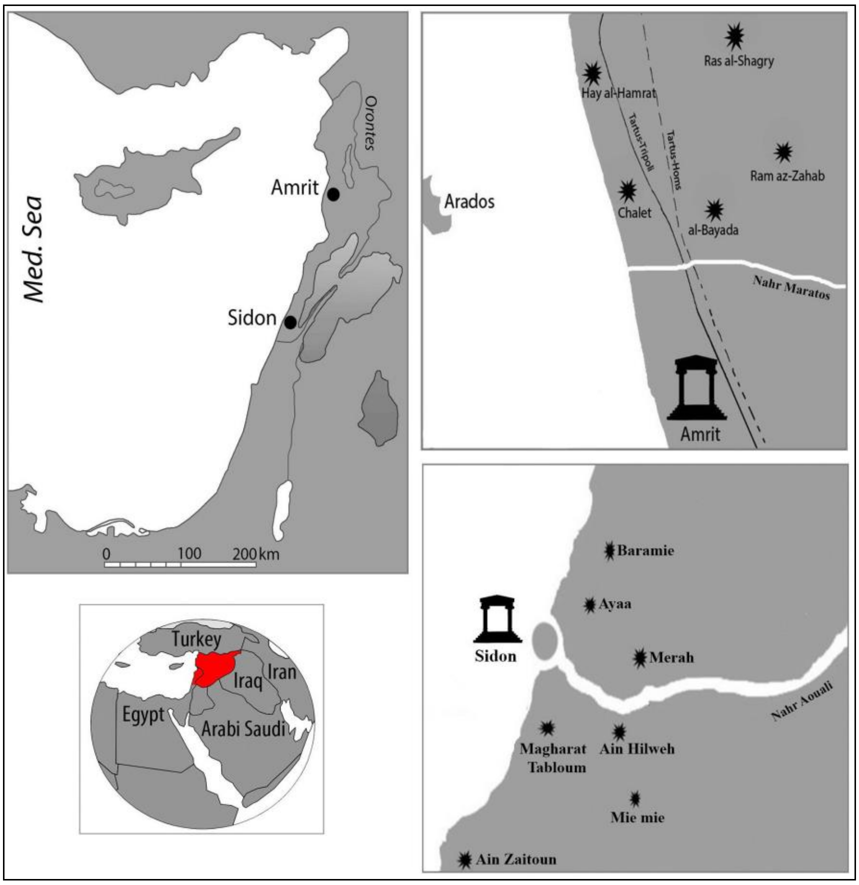


Figure 1. Location of Sidon and Amrit, and their tombs with sarcophagi.

There are also several necropolises and isolated tombs in and around the Amrit site. In *Chalet* (Elayi and Haykal,1996), just a few meters from the coast and about 1500 meters from Amrit, an excavation team led by M. Haykal found five sarcophagi in 1996 (Haykal 1996). The finding of one sarcophagus was documented by (DGAM) in 2009 at *Ras al-Shagry* (Mustafa, 2013; *id*., 2015), situated proximate to *Tell Ġamke* in the neighborhood of the main metropolis of Amrit. In *Bano* about four kilometers to the north of Amrit, one coffin was discovered and documented in 1996 by M. Haykal (Elayi and Haykal, 1996). Other discoveries were made in necropolises such as *Ram az-Zahab* (Haykal, 1996b; Hosh, 2009; Dixon, 2013: 472), in which three sarcophagi were found in 1989, also by M. Haykal. At *al-Bayada* in the vicinity of so-called *Ma'abed* at Amrit one sarcophagus was disinterred accidently

(Lembke, 2001a). Also, in *Hay al-Hamrat* to the north of the ruins of Amrit in a heavily populated area of present-day Tartus two coffins were accidentally uncovered, the first one in 1989 (Lembke, 2001a) and the second in 2001 (Mustafa and Abbas, 2015).

Studies regarding the influences on or styles of Phoenician anthropomorphic sarcophagi have followed trends primarily stemming from the point of view of art history (Frede, 2002; Almagro Gorbea et al., 2010). Beginning with the investigations that appear in the bibliography, many authors establish three distinct phases for the chronologic classification of the personages represented in the sarcophagi:

- Archaic: So called because of the Greco-Egyptian influences (Elayi and Haykal, 1996), characterized by the large dimensions of the sarcophagi, the high quality of workmanship (Buhl, 1963; Frede, 2002), the representation of the beard of Osiris (false beard) as a sign of dignity of the highest authority in Egypt, and the existence of visible collars (Wenger, 2003). The best example is located in the *Ayaa* necropolis (Fig. 2).



Figure 2. Details of Archaic phase period.

- **Persian**. According to Richter Augusta (1970: 182), this period is of an Ionian influence and is identified by hemispherical curls of hair (Almagro-Gorbea et al., 2010).

The *nemes* begin to disappear as they are replaced by a *cap* that covers the hair almost completely (Elayi, 2002).

- **Hellenistic**. Influenced by Classic elements (Lembke, 1998), notable for a considerable reduction in the height of the relief carving of the head (Frede, 2002) and the evolution of the set (box and lid) toward a more rectilinear shape (Elayi and Haykal, 1996).

This artistic view of the evolution of sarcophagi is not shared by some authors (Wenger, 2003). Dating of the sarcophagi continues to be very ambiguous and the attempt to date the earliest productions has always been based on the stylistic schools as principal indicators with which to assign chronologies, omitting the archeological factor (Torrey, 1919/20; Haykal, 1996b; Lembke, 1998; Frede, 2009). Chronologically, these objects are most commonly grouped in five periods:

- The first phase of production of Phoenician sarcophagi is from ca. 535-500 BC., considered archaic, and found in the necropolis of *Ayaa* (Lebanon) (Fig. 3) (Wenger, 2003; Frede, 2004; Versluys, 2010).



Figure 3. Sarcophagus from Ayya tomb.

- The second phase is characterized by the representation of long hair, such as the pieces located in *Kition* (Cyprus) from ca. 490-480 BC. (Frede, 2009).

- The third phase is characterized by spherical hairstyles. Clear examples are the sarcophagi of *Gadir*, dated to ca. 460-450 BC. (Almagro-Gorbea and Torres Ortiz, 2010).

- Egyptian elements mark the fourth stage of production, dating from ca. 460-440 BC. Examples can be found in *Magharat Tabloum* (Sidon) (Elayi and Haykal, 1996).

- The last phase of production is characterized by a smooth top, illustrated by examples in Cyprus, estimated to have originated ca. 400-370 BC. (Buhl, 1964; Frede, 2000: 121).

2. MATERIAL AND METHOD

To date, studies and publications related to Phoenician anthropomorphic sarcophagi have dealt primarily with stylistic questions, very typical of the nineteenth century, with little historical or social context (Buhl, 1963; Elayi and Haykal, 1996; Frede, 2002). Elements such as hair treatment, headdresses, and the representation of the facial features of the personages contained therein, aspects that are normally used for fixing timeframes for production or use, have also been used as indicators of the place of origin of the sarcophagus and/or the affiliated sculptors.

This method alone –complete reliance on the artistic criteria– we suggest is inadequate for the requirements of scientific archeology, for determining the locations of production, and for deducing timeframes for the use of these objects. For this we

need to know the archeological context and possess a more thorough understanding of their place within their culture and society. Specifically, we need the complete social and material cultural context regarding the conception of life and death and the relationship of these sarcophagi to both.

Our examination will focus on studies of anthropomorphic sarcophagi from a statistical point of view, using almost exclusively quantitative variables related first to the external dimensions (length, width and height) of the sarcophagi, and then to various measurements of the anthropoid carvings in the tops.

We can note (Fig. 4) that there is a wide variation in the measurements. However, it is noteworthy that the lengths of the sarcophagi of Sidon are greater than 2.50 meters, while those from Amrit are divided into two distinct groups: less than one meter and greater than 1.4 meters. With respect to width, we can also note two distinct groups

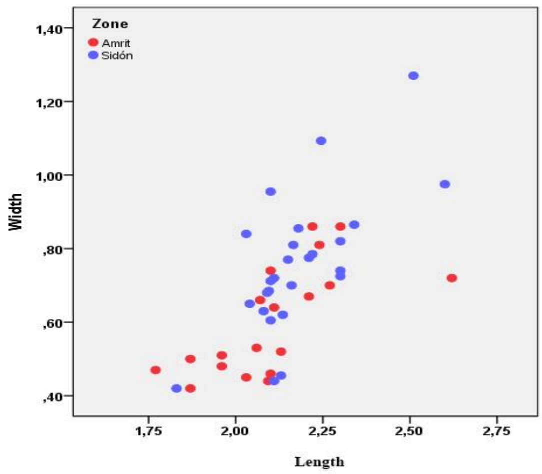


Figure 4. Relation between length and width of complete sarcophagi.

The coefficient of variations related to length is very small, indicating the skillfulness of the work of the stonemasons (CV = 7.3% and 9.5%, Sidon Amrit), while the other dimensions have higher coefficients of variation 23.8%. Interestingly, Sidon length data show that all sarcophagi are more than two meters except one measuring 1.83 meters. In contrast, Amrit sarcophagi length measurements have small values; they are relatively short, excluding one sarcophagus that measures 2.62 meters. In addition to measurements of the sarcophagi themselves, we also made a detailed study of the lid carvings. Conducting a statistical study and analysis of facial features of these sarcophagi is not without its challenges; we only have photographic images to work with and these have been taken from different perspectives with inconsistent scales. Further, in addition to various other problems, the resolution of the photographic image is oftentimes much less than ideal. These challenges led to the requirement for a suitable mathematical model of the faces of the sarcophagi, the most well-defined body part, as the rest of the body, in most cases, is only hinted at. The objective of this analysis is to quantify facial features to allow us to glean the maximum information from this one, common feature of all sarcophagi in our study. Using facial features and characteristics will allow us to create a system of quantification based on measurement variables (Fig. 5).

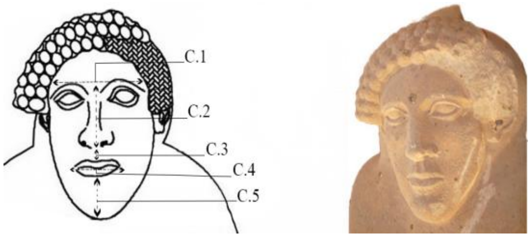


Figure 5. Facial features of anthropomorphic sarcophagus faces.

Firstly, we established five well-defined measurement variables and the relationships between them that reflect the anthropological characteristics of an individual sculpted on the top of a sarcophagus. In the absence of other accurate and reliable data, only photographs from a frontal perspective were considered. To circumvent the problem of having to work in different scales, we transformed facial features into geometric index variables that allowed us to make comparisons based on proportions. For this we used direct measurement variables in a computerized image in AUTOCAD®, yielding these five basic variables:

1) Distance between the eyes
2) Length of the nose
3) Thickness of the upper lip
4) Length of the mouth
5) Length of the chin

These variables make up the core data that will allow us to make an analysis. Some of the measurement sets of our examples were incomplete due to damage to the features being measured or their being covered by distinctive adornments in the upper part of the head (diadems, headbands, etc.). These parts, then, were not included but other measurable parts were maintained in the study. In other cases, entire specimens could not be considered due to the lack of precision in recording the measurements. In order to treat them quantitative-

ly, measurements were converted into index variables based on the distance between the eyes in order to allow us to analyze the following interval variables:

X_2, X_3, X_4 y X_5

$$\forall i,\ Y_2(i) = \frac{X_2}{X_1}, \qquad \forall i,\ Y_3(i) = \frac{X_3}{X_1}$$

$$\forall i,\ Y_4(i) = \frac{X_4}{X_1}, \qquad \forall i,\ Y_5(i) = \frac{X_5}{X_1}$$

Four indices, obtained from the original raw data, will allow us to perform statistical analyses that will possibly enable us to draw conclusions about the sculpted figure. The variable chosen as the base, in this case X^1, is the measurement against which others are compared. Thus its value is not relativized with the others and is not used. The values obtained are:

	$Y_2(i)$	$Y_3(i)$	$Y_4(i)$	$Y_5(i)$
Amrit	C.V.= 18.69 %	C.V.= 19.15 %	C.V.= 33.3 %	C.V.= 22.19 %
Sidon	C.V.= 16.09 %	C.V.= 23.60 %	C.V.= 12.39 %	C.V.= 16.17 %

If we accept that a coefficient of variation of less than 20% indicates homogeneity, we find as a consequence that there are clearly delineated two distinct trends in the anthropological characteristics of the sarcophagi. Faces of those from Amrit show a certain homogeneity regarding length of the nose, while the length of the mouth and chin show greater heterogeneity. This is especially notable in the measurement of the length of the mouth. The faces in the sarcophagi of Sidon are more homogeneous and regular than those from Amrit. The only outstanding feature of note in the carvings found in Sidon is the thickness of the upper lip. It is curious that the most homogeneous variables in Sidon are those corresponding to the lengths of the physical features (nose, mouth, and chin) while in Amrit the only notable features are the very homogeneous length of the nose and upper lip.

Conducting a test of differences shows that the populations of the two analyzed areas, Sidon and Amrit, have different characteristics. Applying a t-student test indicates that there are significant differences between the indices of nose length, upper lip thickness, and length of the mouth, with a level of $\alpha < 0.004$ significance $\alpha < 0.021$y $\alpha < 0.033$ respectively, indicating the existence of very marked differences between the indices. However, with respect to the length of the chin, no statistically significant differences exist ($\alpha < 0.781$), indicating that the differences in the facial characteristics are important (see Index ANOVA factor).

	Media Guadratic	F	Sig.
C_2_Index	.954	9.165	.004
C_3_Index	24.692	5.582	.021
C_4_Index	2.767	4.771	.033
C_5_Index	.017	.078	.781

The significance level for all indices (Fig. 6D) less than C_5 is 95%. We note first that there are no significant differences between the Sidon and Amrit C_5 indices, indicating that the values for the length of the chin are relatively uniform.

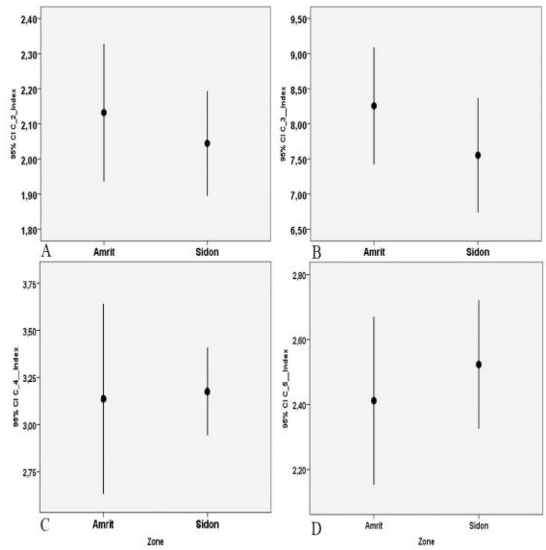


Figure 6 A-D. Index relationship between Sidon and Amrit (C_2, C_3, C_4, C_5)

In addition, C_2 (Fig. 6A) is a variable discriminant itself; the value of this variable allows us to determine if a sarcophagus belongs to Sidon or Amrit, and thus becomes an absolute discriminator. However, both C_4 and C_3 (Fig. 6B-C) are slight discriminators. That is, by using both of them one can determine if a specific sarcophagus originates from one of the regions. They also indicate whether the sarcophagus is from a region other than either Amrit or Sidon. Considering the basic length and

width dimensions highlights a very narrow Pearson correlation (r = 0.806). The trimming line represents the trend of the data:

In relation to the frequency of the raw materials used, petrographic mapping *visu*, shows that marble is the predominant material (Fig. 7).

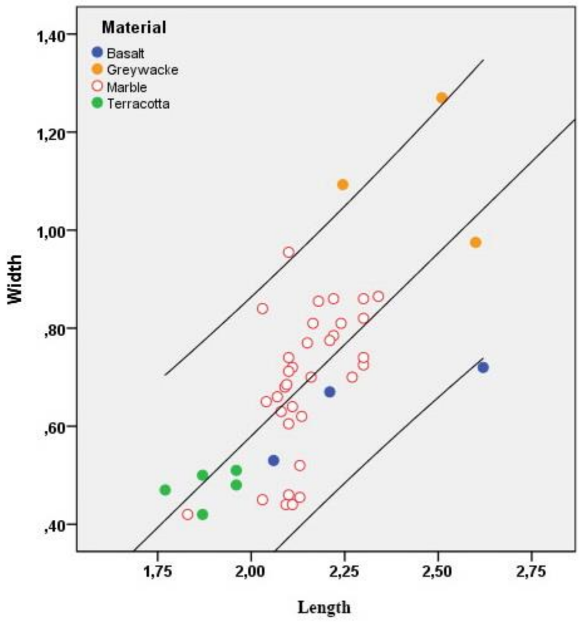


Figure 7. Regression line length and width to raw material.

The length measurements of the sarcophagi are in a very narrow range (mean 2.14m and CV = 3%) except for one that measures 1.18m. However, it is noteworthy that the pieces made of basalt and greywacke are at the high end of the length scale, demonstrating that the material affects the length. Sarcophagi from both regions are made of materials other than marble, such as terracotta, which is used in Amrit to a significant extent. We noted the terracotta sarcophagi comprised a distinct group, being, on average, the smallest.

Moreover, we carried out a cluster analysis of the data using Ward's method, based upon the minimum variance of collected data (Fig. 8). The basis is that the loss of information to form a cluster can be measured by the ratio of the sum of squared deviations between each point (individual) and the average of the group that it joins. This method is very discriminatory in determining the levels of aggregation. Research carried out by Kuiper and Fisher (1975) demonstrated that this method is better suited than others (minimum, maximum, average and centroid) to discriminate against an ideal classification.

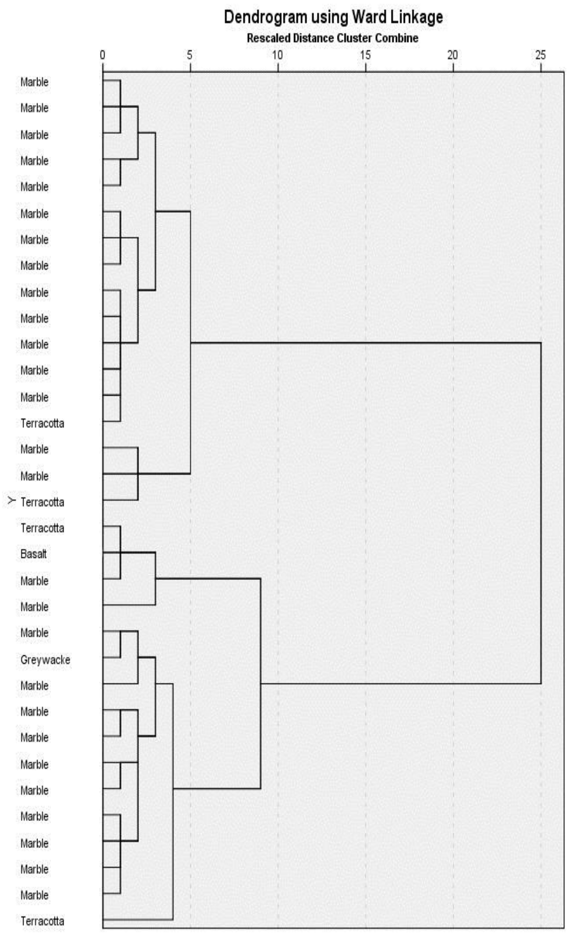


Figure 8. Complete Ward Linkage cluster analysis of the sarcophagi.

The data distribution is performed by aggregating them into four large groups that, in general, are defined by the materials used in construction of the sarcophagi. These groups are characterized by anthropological indices that comprise each one. The first group is composed of marble sarcophagi, with very small values for C_4 and C_5, that is to say, homogeneous values of facial features. The second group consists of marble sarcophagi, also with very small indices, consisting of very small values for C_2, C_3, and C_4, perhaps indicating that it is a group composed mostly of sarcophagi for women and adolescents. The third group mixes materials but again, they are predominantly marble. This group consists of very large individuals (C_3, C_4 are very large, while, C_5 is large but to a lesser extent), showing characteristics completely different from the previous groups. This may be due to their being from a distinct and anthropologically mixed population group and made by different craftsmen. Finally, the sarcophagi in group four show a mixture of materials (terracotta and greywacke, mainly) and the facial features stand out by having a very large nose and chin (large C_2, C_4, and C_5

medium and large), perhaps due to their being from a population of people from distant regions.

3. CONCLUSION

Statistical analyses indicate that measurements of the sarcophagi of Sidon show a very high level of standardization with regard to dimensions, indicating the source of the blocks of stone was the same quarry. Those from Amrit do not seem to follow the same standards; they are not as uniform. Based on the lengths and raw materials of the blocks, we may hypothesize that a certain amount, perhaps only half, of the raw materials of the marble cases could have a common origin. In contrast, in both regions there is a difference with respect to other materials, as is the case with terracotta, greywacke, and basalt.

Quarries and workshops for pre-forming and finishing of sarcophagi from Amrit and Sidon seem to have followed different patterns to shape the coffins. Thus it is possible that two or more quarries were used for extraction of the blocks and that two or more workshops were used for pre-shaping of the sarcophagi.

We analyzed the measurements of the facial features by developing a geometric algorithm to quantify and unify the scale and orientation of the images. The results demonstrate a close relationship among the images of the faces, although there is clear differentiation between the regions of interest. This is possibly because the use of these funerary containers supposedly first began to diminish in Amrit. In addition, there are differences in some details of the facial features. The data, upon close examination using cluster analysis, seems to confirm that these differences were the result of the coffins being finished in different workshops. It is clear that there were a number of different raw materials available and used for the manufacture of these sarcophagi. Based on characteristics of raw materials and the completed coffins, we can establish criteria on which to base the existence of multiple quarries where the raw materials were extracted and the sarcophagi were roughed out.

There has been and is currently significant interest generated by studies undertaken on Phoenician anthropomorphic sarcophagi, although, as stated above, we believe these past studies offer little in the way of empirical and rigorous analysis from an archeological point of view. To date, more attention has been given to artistic style and aesthetics based on the comparison between the subject sarcophagi and pieces of archaic sculptural artworks. This approach results in vague and superficial conclusions because details such as hair treatment, headdresses, and features of the represented person's face and other characteristics of their anatomy are fundamental elements needed to deduce the period of production methods of the parts themselves as well as the period of the final assembly and utilization. Analyzing these objects solely as works of art can only result in approximations of production dates and result in more questions than answers. The most complicated problem, from an archaeological perspective, is the attribution of the observable differences in these sarcophagi to their correct cultural context, and to establish periods of production and use. This is hampered by the lack of archeological context of most of the examples in our possession. Hopefully, new discoveries will alter and improve our understanding of this enigma of the Phoenician anthropomorphic sarcophagus.

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